CLAIMS:

Sub A1

1. A method of investigating radioactive sources in a sample, the method comprising detecting a portion of the emissions arising from the sample at an energy, the detected portion relating to a detected level, the detected level being corrected according to a correction method to give a corrected level, at that energy, the correction method including:-

the provision of an emission generator, passing at least a portion of the emissions of the generator into the sample, detecting at least a portion of the emissions from the generator leaving the sample, and determining a value for a first relationship between the two portions;

calculating a value for a relationship of equivalent type to the first, the calculation being based on functions of an element's absorption of emissions and the amount of that element potentially encountered by emissions, for one or more elements;

adjusting one or more variables / functions in the calculated relationship to reduce the difference between the value of the determined relationship and the value of the calculated relationship for the sample at a plurality of the energies of emissions from the generator; and

obtaining the values of the calculated relationship functions at a reduced difference, and calculating from those function valves, the calculated relationship at the sample source emission energy requiring correction, the detected level being corrected to the corrected level using those function values.

2. A method according to claim 1 in which the generator emissions are of at least two emission energies and at least two of those energies are detected.

3. A method according to claim 1 or claim 2 in which the calculated relationship is based on functions addressing one or more of the density, emission path length in the sample and sample absorption of emissions.

4. A method according to any preceding claim in which the calculated relationship is based on functions addressing one or both of the effect of the material forming the sample over the emission path length in the sample and the sample absorption of emissions.

5. A method according to any preceding claim in which the calculated relationship is based on the equation:-

$$T_i = \exp\left(-\sum q_j . \mu_{i,j}\right)$$

where T_i is the transmission coefficient at the energy i under consideration; q_j is the effective material thickness or the effect of the specified material forming the sample over the specified emission path length through the sample, for element j; $\mu_{i,j}$ is the mass absorption coefficient for elements j at energy i.

6. A method according to claim 5 in which the calculated relationship includes contributions from three or more elements, j.

7. A method according to claim 5 or claim 6 in which the elements include at least one low atomic mass element, preferably less than 10, at least one high atomic mass element, preferably greater than 40 and at least one

intermediate atomic mass element, preferably between 10 and 50.

8. A method according to any preceding claim in which the adjusting of the variables / functions / factors varies one or two of the variables / functions / factors only.

9. A method according to any preceding claim in which the reduction in the differences between the first relationship value and calculated value is undertaken so as to reduce the overall difference between all of the first relationship and calculated relationship values involved.

10. A method according to any preceding claim in which the first relationship employs measured transmission coefficients.

11. A method according to claim 10 in which the measured transmission coefficients, for one or more of the energies are provided according to the equation:-

$$\text{Trans. Coeff.} = \frac{R}{R_o}$$

where R is the rate of detected photons with the sample in place, R_o is the rate of photons which would be detected without the sample in place.

12. A method according to any of claims 1 to 11 in which the generator emits energies encompassing the energy or range of energies emitted by the sample.

13. A method according to any of claims 1 to 11 in which the emission energies of the generator extend across at least 50% of the range of energies emitted from the sample.

14. A method according to any of claims 1 to 13 in which at least 5 energies from the generator are detected and used.

15. Apparatus for investigating radioactive sources in a sample, the apparatus comprising:

one or more detectors for emissions from the sources, the detectors generating signals indicative of the emissions detected;

an investigating location into which the sample is introduced;

signal processing means for relating the detector signals to a detected level for the sources;

processing means for correcting the detected level for the sources, according to a correction method, to give a corrected level;

a radioactive emission generator separate from the sample;

one or more detectors for emissions from the generator which leave the sample;

processing means for determining a first relationship, based on the portion of generator emissions entering the sample and the portion of generator emissions leaving the sample;

processing means for calculating a value for a relationship of equivalent type to the first relationship, the calculation being based on functions of an element's absorption of emissions and the amount of that element potentially encountered by emissions, for one or more elements;

processing means for adjusting one or more values of the functions in the calculated relationship to reduce the

difference between the value of the determined relationship and the value of the calculated relationship for the sample at a plurality of the energies of emissions from the generator; and

calculating means for obtaining the values of the calculated relationship functions at the reduced difference and calculating from those function values the calculated relationship at the sample source emission energy requiring correction, the detected level being corrected to the corrected level using those values.

Add A2